Amendments to the Specification

Please replace paragraph [0015] with the following amended paragraph:

[0015] Waveguide tapers are important for coupling between waveguides having different mode sizes. Taper in the horizontal (width) direction ~~are~~ is relatively simple to make using a mask with a horizontal taper pattern. Waveguides tapered in the vertical (thickness) direction are particularly difficult to make, but are important for minimizing coupling loss when coupling waveguides. For example, a vertical taper is important for coupling an optical fiber to a silicon waveguide.

Please replace paragraph [0080] with the following amended paragraph:

[0080] The present invention provides a method for forming a vertical taper in a waveguide. In the present invention, a shadow mask is disposed above a waveguide requiring a vertical taper. Then, the waveguide is exposed to a directional etching process (e.g. deep reactive ion etching) while the mask is moved. As[[k]] the mask moves, different regions of the waveguide will be etched different depths, resulting in a vertical taper in the waveguide.

Please replace paragraph [0090] with the following amended paragraph:

[0090] In a method of the present invention, a waveguide is formed on a substrate. The waveguide can be made of many materials including Si, GaAlAs, GaAs, InP, silicon oxynitride, doped glass or other materials. The present invention is applicable to any waveguide material that can be etched by ion ~~bean~~ beam milling, dry etching, or the like. The substrate materials include semiconductors such as silicon, ceramics and the like. The substrate may be clad. Optionally, the waveguide has a horizontal taper shape (i.e., the waveguide is tapered as viewed from above). The waveguide may be a rib waveguide. A starting point waveguide 1 over a substrate 3 may be seen in a top view in Fig. 1(a), and in a

side view in Fig. 1(b). The horizontal tapering is achieved with conventional photolithography and etching.

Please replace paragraph [0095] with the following amended paragraph:

[0095] The waveguide is etched, with, for example, reactive ions 7, through a mask 5 that is movable with respect to the substrate 3. The sequence of figures 2(a)-2(d) illustrates the etching of the waveguide 1 during the etching process. It is noted that the length of the taper may be about 0.5-1 mm. If the substrate 3 is a circular wafer, then the motion of the mask 5 is in the plane of the substrate and in a radial direction. Wafers usually are provided with flats for keying, and the motion may also be described as linear, as opposed to rotational, with respect to the flat. As the mask 5 moves, areas of the waveguide 1 beyond the edge of the mask 5 are exposed to greater etch times than other areas, which produces a waveguide 9 with a vertical taper. In this embodiment, the mask 5 moves in a linear direction with respect to direction of the waveguide 9.

Please replace paragraph [0140] with the following amended paragraph:

[0140] In another embodiment of the invention, the mask is moved with non-constant velocity so that a non-uniform etch pattern is established on the waveguide 21 surface, as can be seen in Figs. 6(a) and 6(b). For example, if a mask 19 with slits or openings 20 is moved with an oscillatory velocity, then a corrugated surface 23 is formed. In this way, the present invention can be used to make diffraction gratings, such as Bragg filters, on the substrate surface. The mask 19 is moved during RIE or ion milling, for example. In this example, the mask 19 is moved with an approximately sinusoidal velocity. An advantage of the present invention is that by using, for example, a mask with an edge, and then a mask with slits, a single monolithic optical device can be made on a substrate comprising both a vertical tapered waveguide and a Bragg diffraction filter. This is done, for example, by first making a vertical tapered waveguide on one end of a layer of an optical waveguide material on a substrate, masking the vertical tapered waveguide, and then making a diffraction grating on

the surface of the other end (which is not vertically tapered) of the waveguide. Thus, avoiding the dB coupling losses incurred by making such an optical device by coupling a ~~discreet~~ discrete waveguide and a ~~discreet~~ discrete filter. Hence, a waveguide capable of coupling to an optical fiber with a built in frequency filter is provided.

Please replace paragraph [0145] with the following amended paragraph:

[0145] This is particularly useful in producing, for example, splitters for dense wavelength division multiplexers. Another embodiment is to make a vertically tapered waveguide, then provide a diffraction grating on the tapered surface, by using a mask with slits tilted to an angle ~~that~~ matched to that of the vertical taper, so that the motion of the mask is out of plane with the substrate.